Revolutionizing Outcomes with Innovative Negative Pressure Therapies (NPTs):

Insights from a Multispecialty Roundtable

Supported by an educational grant from Smith+Nephew

Faculty

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  Trumbull, CT
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Faculty Disclosures

- **Lee Goldstein, MD, FACS**
  Speakers Bureau: LifeNet Health; Smith+Nephew

- **Adam Wright, MD**
  Consultant: Stryker Orthopedic Instruments
  Speakers Bureau: Smith+Nephew

Disclosures

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- Applicable CME staff have no relationships to disclose relating to the subject matter of this activity
- This activity has been independently reviewed for balance

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Learning Objectives

- Evaluate clinical applications of single-use negative pressure wound therapy (sNPWT) and traditional negative pressure wound therapy (tNPWT) solutions across closed surgical incisions and open/complex wounds
- Differentiate negative pressure therapy (NPT) device selection strategies through case studies based on wound type, surgical specialty, and care setting to optimize outcomes
- Apply multidisciplinary best practices for integrating NPT into vascular, plastic, and orthopedic workflows to improve efficiency and healing results

sNPWT = single-use negative pressure wound therapy; tNPWT = traditional negative pressure wound therapy; NPT = negative pressure therapy.

To participate in polling, please scan the QR code



Negative Pressure: An Orthopedic Perspective

Adam Wright, MD
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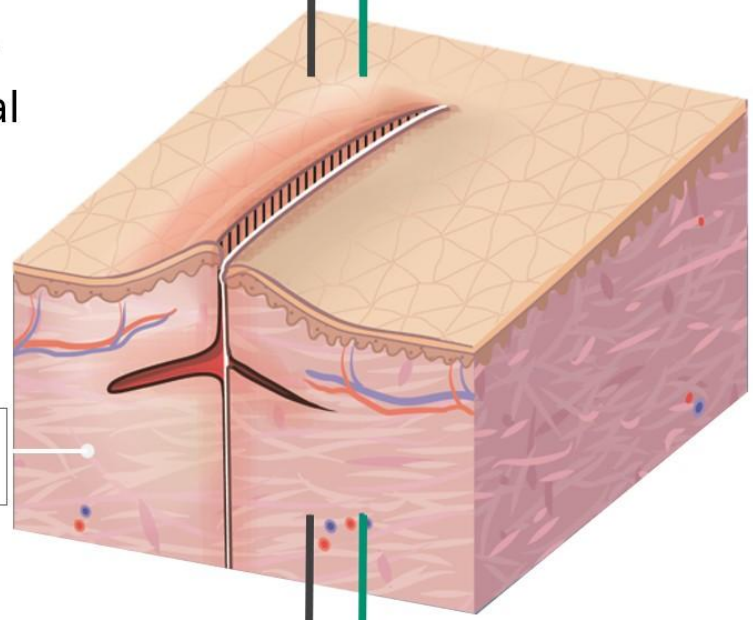
Mechanism of Action of Negative Pressure Devices

NPWT Mechanism of Action

Standard Dressing

Acts at the wound surface

- Provide a barrier to external infection and help absorb wound fluid from the skin surface (exudate)



NPWT

Acts via multiple mechanisms, may help

- Improve wound contraction
- Reduce fluid build-up
- Promote changes in blood flow (perfusion)
- Increase lymphatic drainage*
- Stimulate growth of new blood vessels (angiogenesis)

*as demonstrated in vivo

Loveluck J, et al. *ePlasty*. 2016;16:e20. Glaser DA, et al. *Wounds*. 2012;24(11):308-16. Kilpadi DV, et al. *Wound Repair Regen.* 2011;19:588-596. Birke-Sorenson H, et al. *JPRAS.* 2011;64(Suppl):S1-S16. Scalise A, et al. *Int Wound J.* 2016;13:1260-1281. Shim HS, et al. *Biomed Res Int.* 2018;2018. Malmsjö M, et al. *ePlasty.* 2014;14:e15. Ma Z, et al. *Exp Ther Med.* 2016;11(4):1307-1317. Xia CY, et al. *Mol Med Rep.* 2014;9(5):1749-1754. World Union of Wound Healing Societies (WUWHS) Consensus Document. Closed surgical incision management: understanding the role of NPWT. *Wounds International,* 2016.

Polling Question

POLL

Compared with traditional NPWT, how is negative pressure delivered with single-use NPWT?

A. It is concentrated at the wound bed under the foam filler

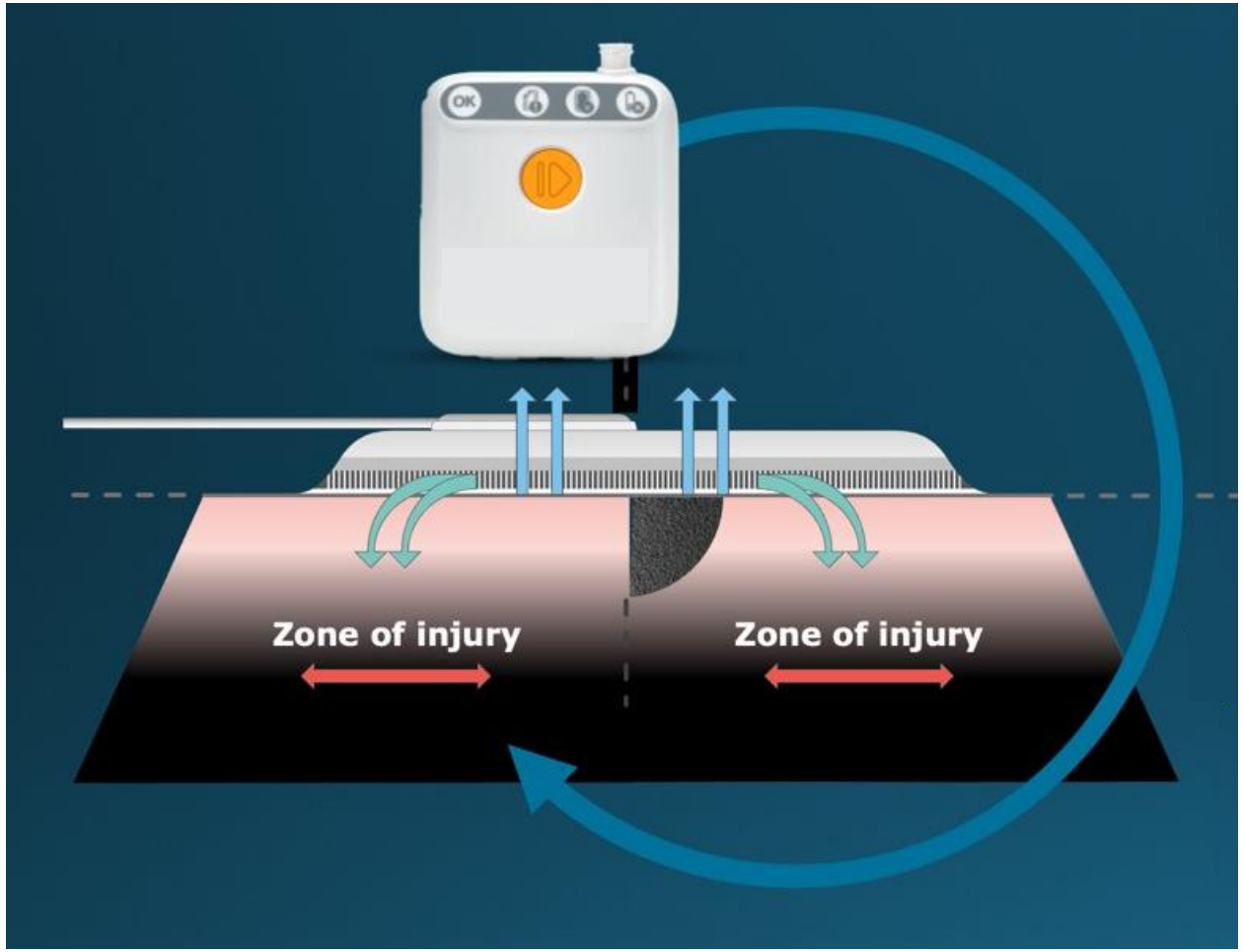
B. It is dispersed across the entire tissue under the dressing

C. It is delivered only at the dressing port site

D. It is delivered intermittently to the wound edges only

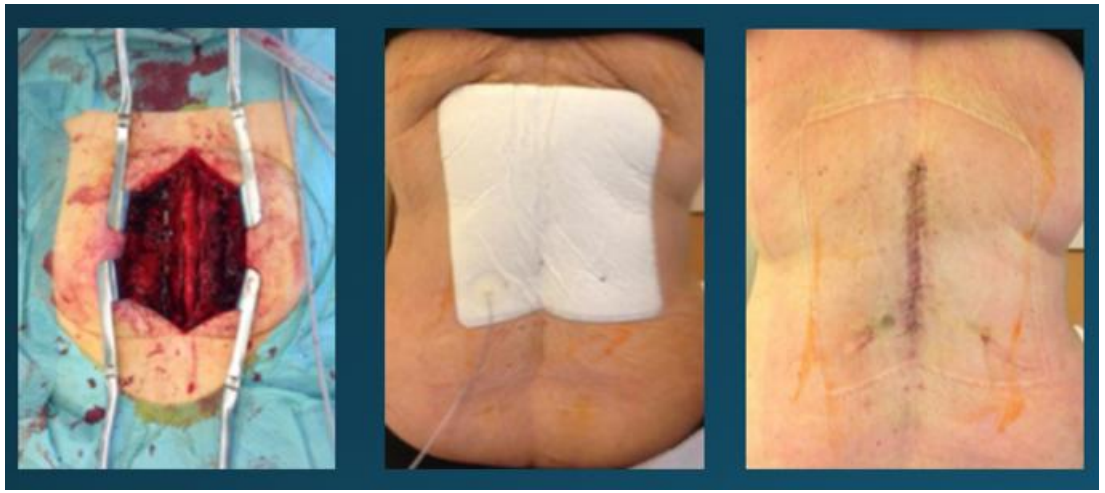
Single-Use Negative Pressure Wound Therapy

- The PICO™ System single-use negative pressure wound therapy (sNPWT) dressing protects from external contamination, locks exudate and bacteria away
- sNPWT delivers compressive force to stimulate cellular response activation to encourage tissue healing below the wound or incision
- sNPWT allows the delivery of negative pressure across the entire dressing to ensure that treatment is delivered beyond the wound/zone of injury



Wider Zone of Therapy

- Consistent delivery of negative pressure with sNPWT in clinical practice

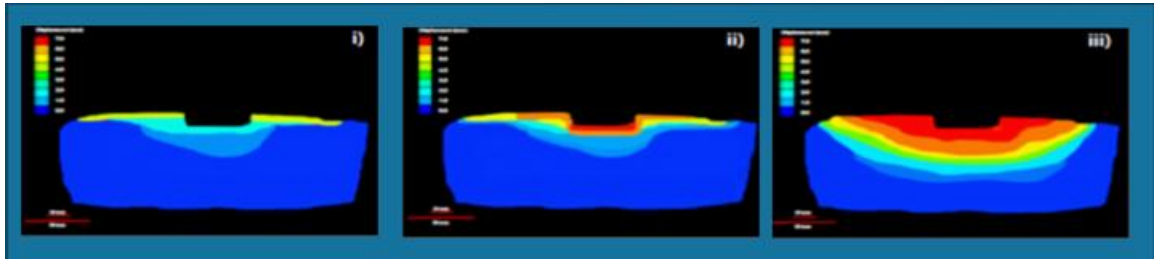


Photographs courtesy of Dr. M. Brem, center photograph included in Nordmeyer, et al.

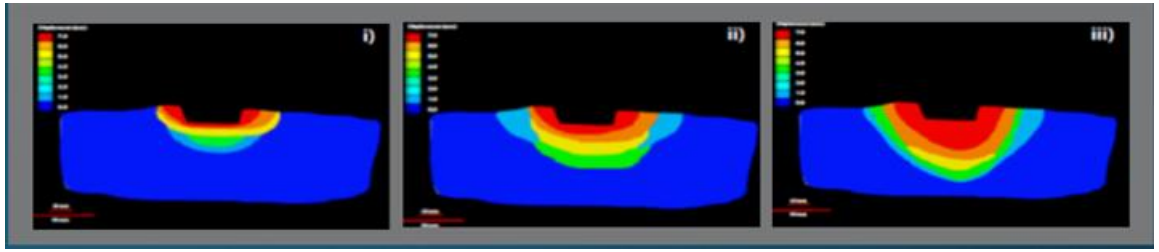
Visible effects of sNPWT on tissue surrounding the wound in patients who underwent spinal surgery (dressing boundary visible)

- sNPWT is dispersed across the entire tissue under the dressing

sNPWT



tNPWT



CT scanning of tissue displacement under sNPWT and tNPWT over 24hrs in a porcine tissue model

What is the evidence for negative pressure in different wound types and across medical specialties?

In a randomized controlled trial, sNPWT helped to reduce the incidence of SSCs and reduce LoS (including extreme LoS) compared with standard dressings in primary hip and knee arthroplasty

76.2%

The sNPWT system resulted in a nearly 4x reduction superficial SSCs* (2.0% vs 8.4%; *p*=.06)

59.5%

The sNPWT system helped in significantly fewer dressing changes* (2.5% vs 4.2%; *p*=.002)

100%

The sNPWT system helped to significantly reduce extreme LoS (≥13 days; 0 vs 2%; *p*=.003)

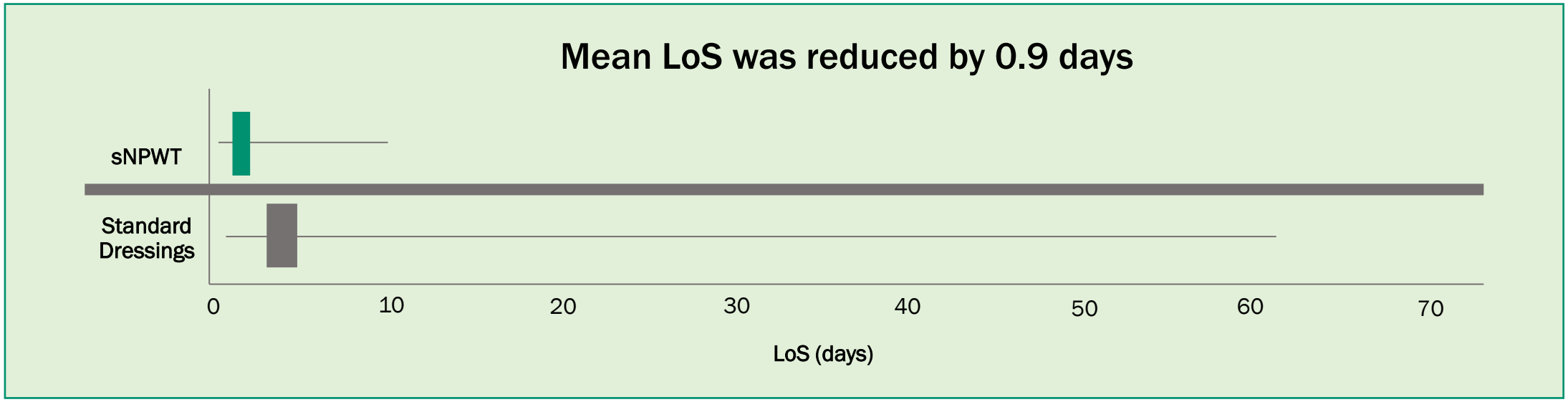


Figure. Mean LOS (and range) with sNPWT and standard dressings

*vs standard dressings

SSC = surgical site complication; LoS = length of stay.

Karlakki SL, et al. *Bone Joint Res.* 2016;5(8):328-337.

sNPWT on SSIs by Surgical Incision Type

sNPWT was found to significantly reduce the risk of surgical site infections (SSIs) vs standard dressings when analyzed by surgical specialty*, as well as an average reduction in LoS**

Orthopedic surgery

57%

odds reduction



Vascular surgery

78%

odds reduction



Obstetric surgery

51%

odds reduction



Breast surgery

64%

odds reduction





1.75 days

average reduction in LoS

*In a meta-analysis of 29 studies in a variety of surgical indications, including 11 RCTs with a total of 5,614 patients
**MD: -1.75; 95%; CI: -2.69 to -0.81; *p*=.0002

SSI = surgical site infection.
Saunders C, et al. *BJS Open.* 2021;5(1):328-337.

Clinical Evidence: Orthopedics

Real-world results

- Compared to PREVENA™ closed-incision NPWT (ciNPWT), PICO™ sNPWT system demonstrated significantly financial burden to healthcare providers, as well as a significant relative reduction* in the odds of developing dehiscence

*sNPWT patients also showed reduced odds (p=ns) of developing SSIs at 30 days, superficial SSIs at 30 days, deep SSIs at 90 days, and seroma at 30 days

Clinical outcomes

63.9%
Significantly lower odds of dehiscence
(*p*<.05)

29.7%
Significantly lower length of stay
(*p*<.0001)

Cost of care

21.7%
Cost reduction at admission
(*p*<.0001)

20.67%
Cost reduction 30 days postop
(*p*<.0001)

20.78%
Cost reduction 90 days postop
(*p*<.0001)

Bashyal RK, Searle R, Nherera LM, Wright A. *J Wound Care.* 2025;34(8):555-562.

sNPWT Case Study: Reduction Mammoplasty

200 patient bilateral breast study in U.S., South Africa, and Netherlands measured **sNPWT** vs **standard care**

Follow-ups

- Wound-related complication rates: 21 days
- Aesthetic appearance (cosmesis) and scar quality: 42 and 90 days

Results

- **Fewer complications** observed within 21 days following sNPWT *(p=0.004)*
- Fewer incidences of dehiscence observed by day 21 following **sNPWT treatment n=32 (16.2%)** vs **n=52 (26.4%)** *(p<0.001)*
- Minimizing tension, enhanced hydration, and negative pressure application may explain sNPWT-related improvements in scar quality within the study period



Galiano R, et al. *Plast Reconstr Surg Glob Open*. 2018;6(1):e1560.

Polling Question

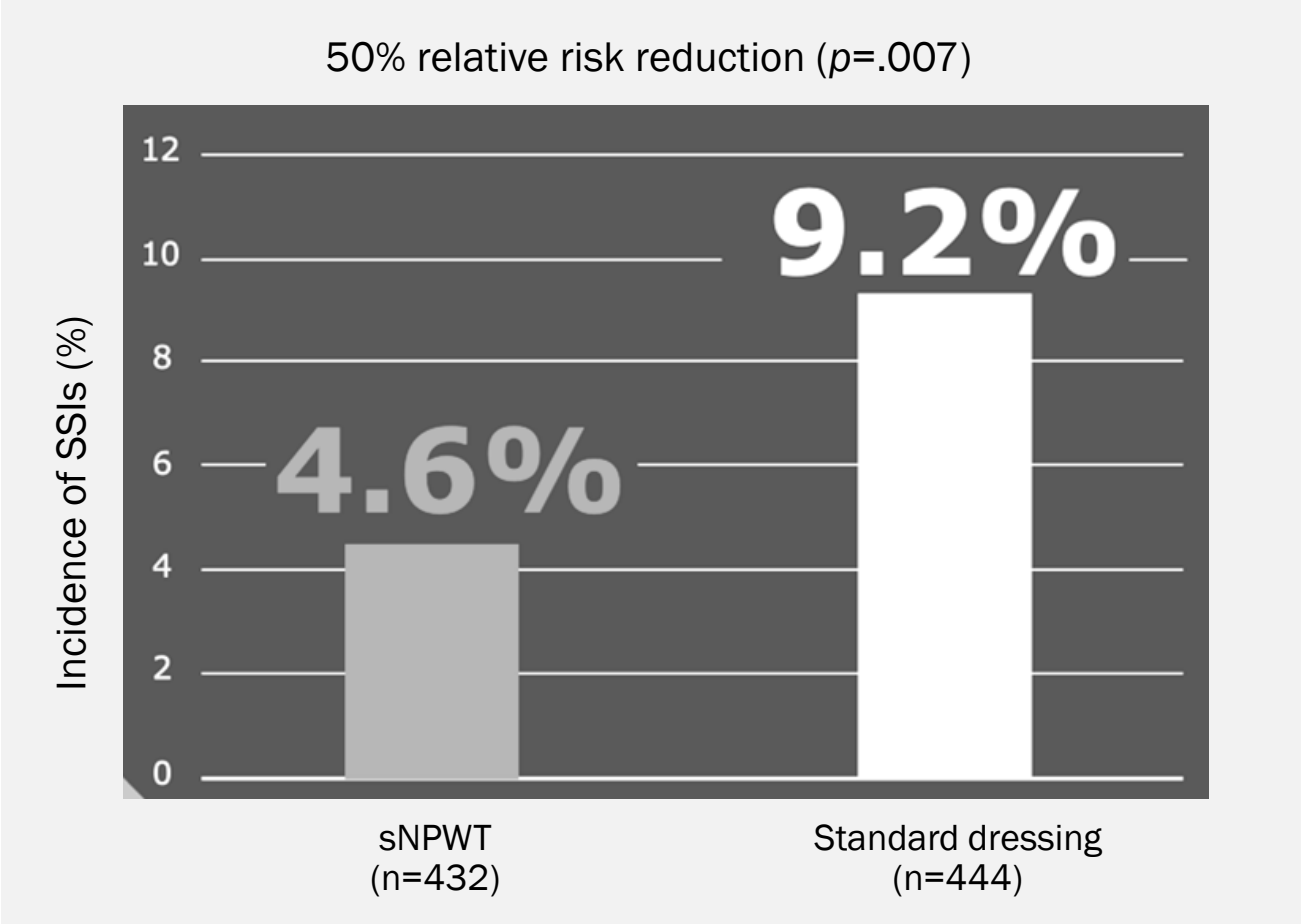
POLL

In women with pre-pregnancy BMI ≥30 undergoing C-section, sNPWT could reduce the relative risk of SSI

A. True
B. False

50% reduction in relative risk of SSIs

In an RCT of 876 women undergoing C-section with pre-pregnancy BMI ≥30, sNPWT significantly reduced the relative risk of SSI by 50% compared with standard dressings (*p*=.007)



Incidence of SSIs with sNPWT and standard dressings in obese pregnant women undergoing C-section

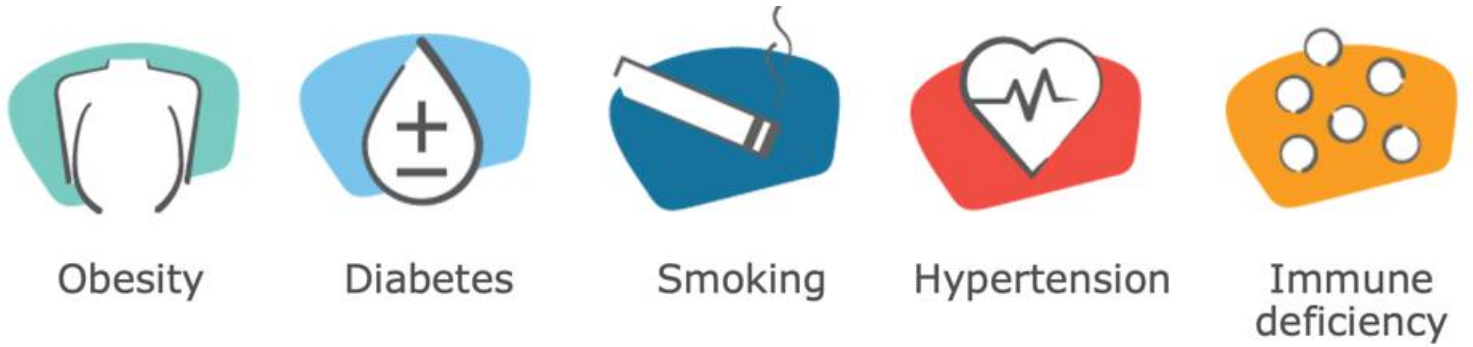
Pain reduction

The prophylactic use of sNPWT in women undergoing C-section with pre-pregnancy BMI ≥30 demonstrated a statistically significant reduction in pain scores, compared with standard care on postop day 2

Tuuli MG, et al. *Am J Obstet Gynecol*. 2017;216(1):S245.

Who would benefit from NPWT?

How Do You Define Risk?



Guo S, Dipietro LA. *J Dent Res*. 2010;89(3):219-229.

Case: High-Risk Total Hip Arthroplasty

Patient profile

- 76y Female
- Diagnosis: left hip osteoarthritis
- Plan: left total hip arthroplasty

Risk factors

- BMI 45
- Large pendulous abdominal pannus
- Diabetic, hemoglobin A1C 7.3
- Thin, friable skin



Charles Lawrie, MD (Baptist Health Orthopedic Institute)

Case: High-Risk Total Hip Arthroplasty

Wound check:
2 wks postop

- Wound healing well
- Sutures removed





Charles Lawrie, MD (Baptist Health Orthopedic Institute)

Case: High-Risk Total Hip Arthroplasty



6 wks postop



6 wks postop

— Follow-up —

> “I did not have to worry about my incision with PICO™. I just left it alone, and it healed great.

Charles Lawrie, MD (Baptist Health Orthopedic Institute)

Case: High-Risk Knee Arthroplasty

Patient profile

- 55y Male
- Diagnosis: Left knee osteoarthritis
- Plan: Left primary TKA

Risk factors

- History of multiple left knee surgeries, presenting with **multiple prior incisions**
- ACL reconstruction x2
- High tibial osteotomy
- Arthroscopic debridement



Clinic Preop



Charles Lawrie, MD (Baptist Health Orthopedic Institute)

TKA = total knee arthroplasty.

Case: High-Risk Knee Arthroplasty



Planned incision
Intraoperative prior to incision



Closure
Immediately after closure



Dressing
Immediately after sNPWT placement

Charles Lawrie, MD (Baptist Health Orthopedic Institute)

Planned incision

- Dominant blood supply to anterior knee comes from the medial side
- Use the most lateral incision to avoid devascularization
- Flaps must be full-thickness when developed

Closure

- Capsular closure with running barbed monofilament suture
- Subcutaneous closure
  - 2-0 interrupted monofilament
  - 3-0 nylon horizontal mattress in skin

Dressing

- sNPWT 15cmx30cm applied directly to incision in 30 degrees of flexion
- Used wider sNPWT dressing than normal to cover incisions AND medial flap to increase flap perfusion
- Sealed at periphery with adhesive strips

Malmsjö M, et al. *ePlasty*. 2014;14:e15. Ma Z, et al. *Exp Ther Med*. 2016;11(4):1307–1317. Xia CY, et al. *Mol Med Rep*. 2014;9(5):1749–1754.

Case: High-Risk Knee Arthroplasty



7 days postop prior to dressing change



7 days postop during dressing change



6 wks postop

Wound check: 7 days postop

- Dressing clean and dry
- Incision clean and dry
- No areas of focal dehiscence
- No signs of infection
- Medial flap well perfused without necrosis

Wound check: 2 wks postop

- Dressing removed at 2 wks postop
- No blistering or damage to surrounding skin
- Incision healing

Clinical Pearls

- Consider your patient and their risk factors
- High-risk or high-consequence?
- Ease of use
- Cost/benefit/risk

Negative Pressure Wound Therapy for Complex Open Wounds

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Vascular and Wound Care Surgeon, Hartford HealthCare
Medical Director, Wound Care, Fairfield Region, St. Vincent's Medical Center
Trumbull, CT

On what types of wounds do you use NPWT? Which wounds should you not?

Complications Related to NPWT

- Bleeding/friable tissue
- Device-related pressure injury (DRPI)
- Injury to deep structures
- Retained dressings, foam fragments
- Odor
- Difficulty/complexity of medical devices

DRPI = device-related pressure injury.

Uncontrolled Bleeding



- Immediately stop negative pressure
- Remove the dressing (potentially in operating room)
- Assure hemostasis

Polling Question

POLL

Which strategy helps prevent retained foam dressings in NPWT?

A. Pack large-pore foam tightly into deep tunnels

B. Extend the interval between dressing changes

C. Use white foam and/or non-adherent dressings

D. Cut foam into small fragments for easier removal

Retained Dressings



- Removal causes significant morbidity, wound injury, and bleeding
- Time-consuming for providers, frustrating for patients
- Avoid packing large pore foam into deep tunnels
- Use white foam and/or non-adherents

Pressure Injury

- DRPI can happen in any setting
- Care must be taken to bridge dressings off weight-bearing surfaces



Complex Sacral Wound Management

Presentation

- 73y Male partial quadriplegic from teenage yrs (athletic injury), known to me from yrs prior with prior small excoriations and decubitus wounds
- Prior MI, CAD, chronic ischemic heart disease
- Presented to another hospital that began 6 wks of ceftriaxone without diagnosis of osteomyelitis
- Presented to our facility with large open midline sacral decubitus wound, Stage 4, down to and including the deep musculature of the buttocks
  - There was a second more proximal PI with dark ecchymotic tissue
  - The larger open wound over the distal sacrum communicated with undermining to the new area of injury
  - Palpable bone, with intact periosteum
  - There is necrotic musculature along the walls of the cavity

MI = myocardial infarction; CAD = coronary artery disease; PI = pressure injury.

Presentation



Next Steps: Initial Visit

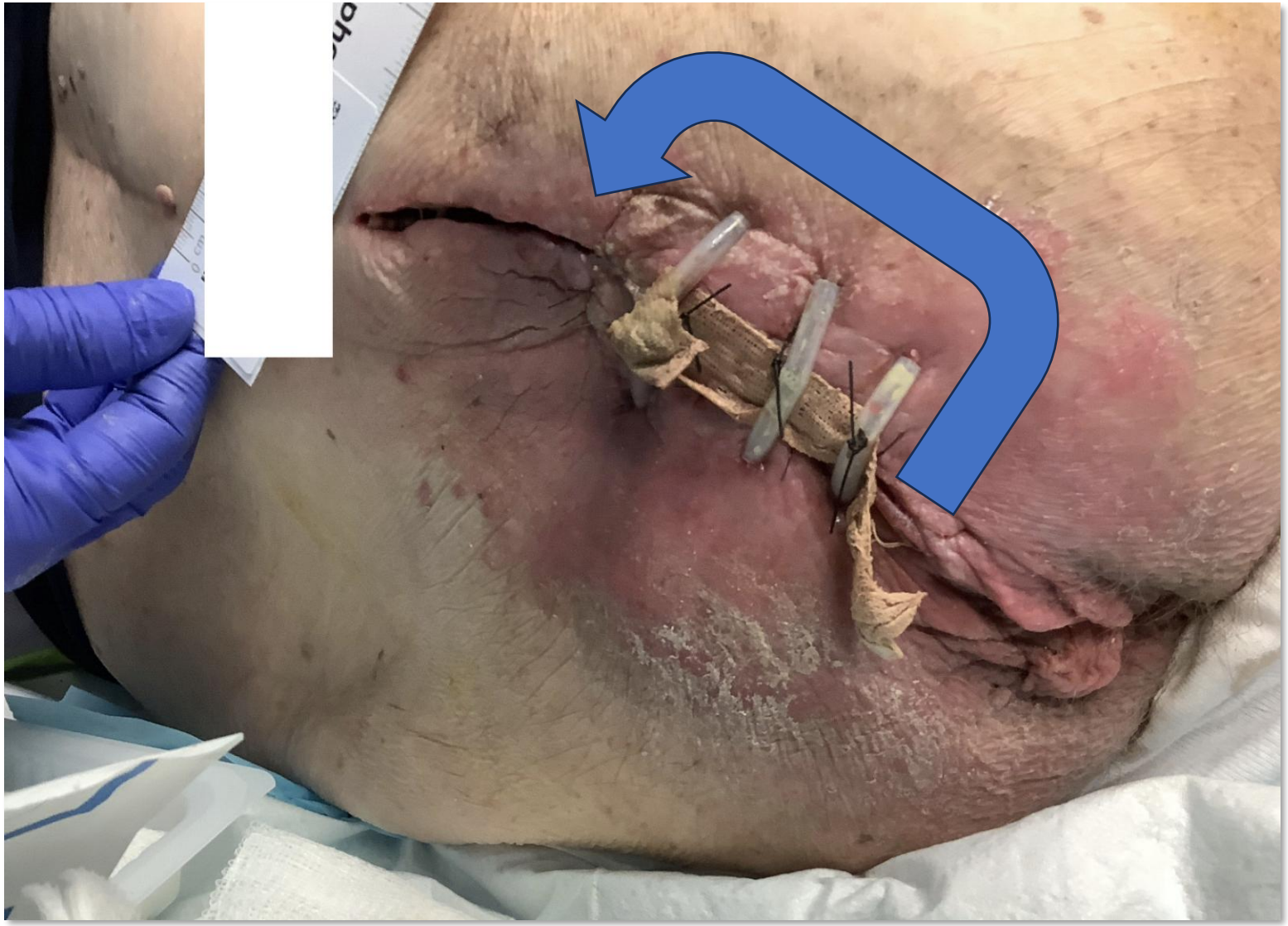
- Ensure support surfaces both at home and in his chair are adequate
- Minimize time in the chair or on the wound
- Discussed high-protein nutrition
- Rule out osteomyelitis – 3-phase bone scan ordered
- Divert fecal stream – the patient has no control, and the wound is too close to the anus; referred to colorectal surgery
- Debridement of musculature
- Washout, examination of the extent of the wound, deep wound cultures, possible partial closure
- I was hopeful I could start surgically advancing the wound cephalad

Bone Scan

IMPRESSION:

Soft tissue activity at the sacral region without radiotracer uptake on delayed/osseous phase of the bone scan, suggestive of known sacral decubitus wound without scintigraphic evidence of osteomyelitis.

POD 1



- Washed out distal wound, reapproximated viable muscle across the midline
- Antibiotic beads placed
- Deep cultures
- Reapproximated healthy bleeding skin
- Reinforced closure of lower wound with placental membrane graft
- NPWT ordered
- Strict offloading

Operative Cultures

Special Requests	SACRAL WOUND
Gram stain suggestive of	Few neutrophils No organisms seen
Culture	**Klebsiella oxytoca !**
Culture	**!** **Yeast** **If further work-up is clinically indicated, contact Microbiology**
Culture	No anaerobes isolated after 7 days

Susceptibility

	Klebsiella oxytoca (REPORT) BACTERIAL MIC AND INTERPRETATION (MCG/ML)	
Amoxicillin/Clavulanate	**Susceptible**	
Ampicillin	**Resistant**	
Ampicillin/Sulbactam	**Resistant**	
Cefazolin	**Resistant**	
Cefepime	**Susceptible dose dependent** [1]	
Ceftazidime	**Resistant**	
Ceftriaxone	**Resistant**	
Ciprofloxacin	**Resistant**	
Ertapenem	**Susceptible**	
Gentamicin	**Resistant**	
Levofloxacin	**Susceptible**	
Meropenem	**Susceptible**	
Piperacillin/Tazobactam	**Susceptible dose dependent** [2]	
Tetracycline	**Resistant**	
Tobramycin	**Resistant**	
Trimethoprim/Sulfamethoxazole	**Resistant**	

NPWT

- NPWT instituted POD 3
- RENASYS™ WOUND+ (tNPWT) device chosen due to the wound being entirely posterior and on a weight-bearing surface
- RENASYS™ Soft Port (tNPWT soft port) chosen

Polling Question

POLL

Why would a tNPWT soft port be selected for a wheelchair-bound patient with a sacral wound?

A. To reduce the need for bridging and the risk of pressure injury over a long treatment course

B. To allow the patient to self-manage without clinic visits

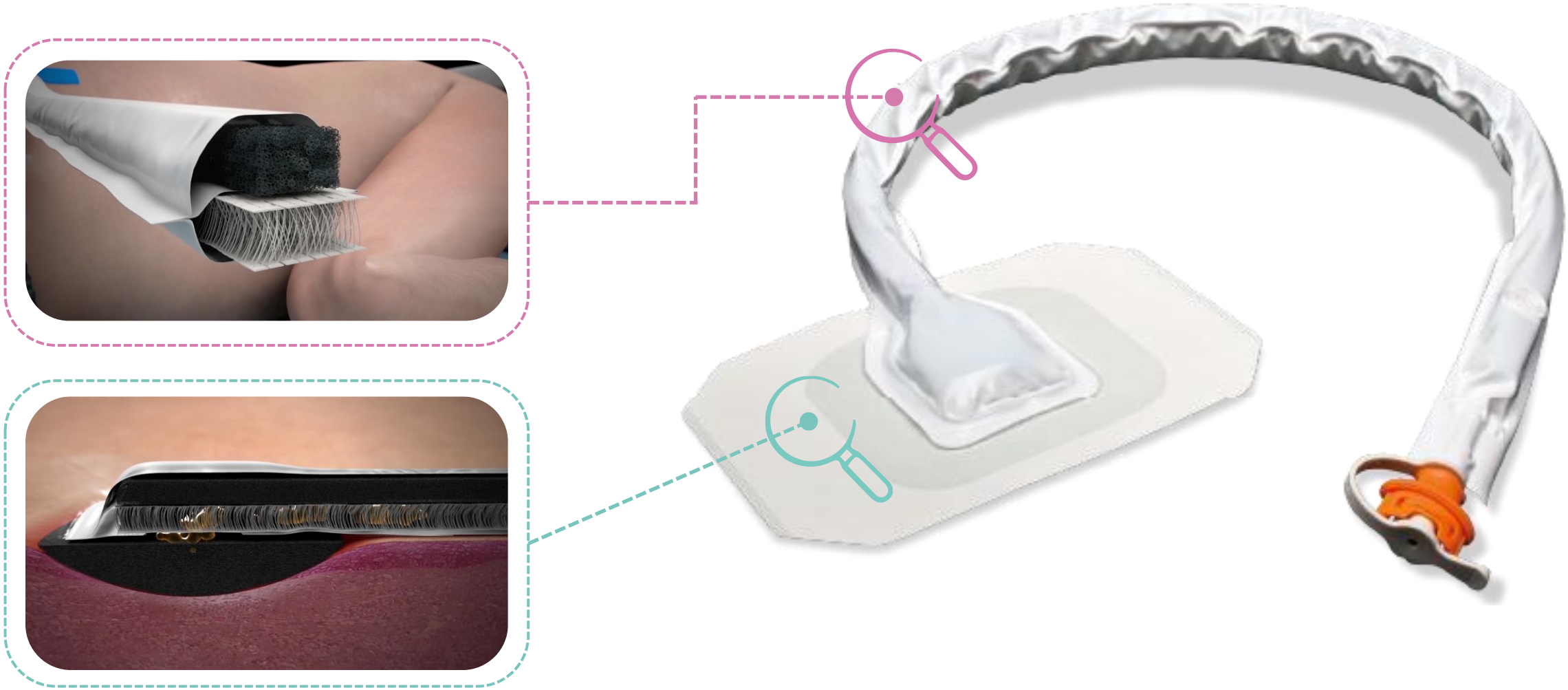
C. To provide higher negative pressure than standard ports

D. To avoid the need for a foam filler in the wound

NPWT

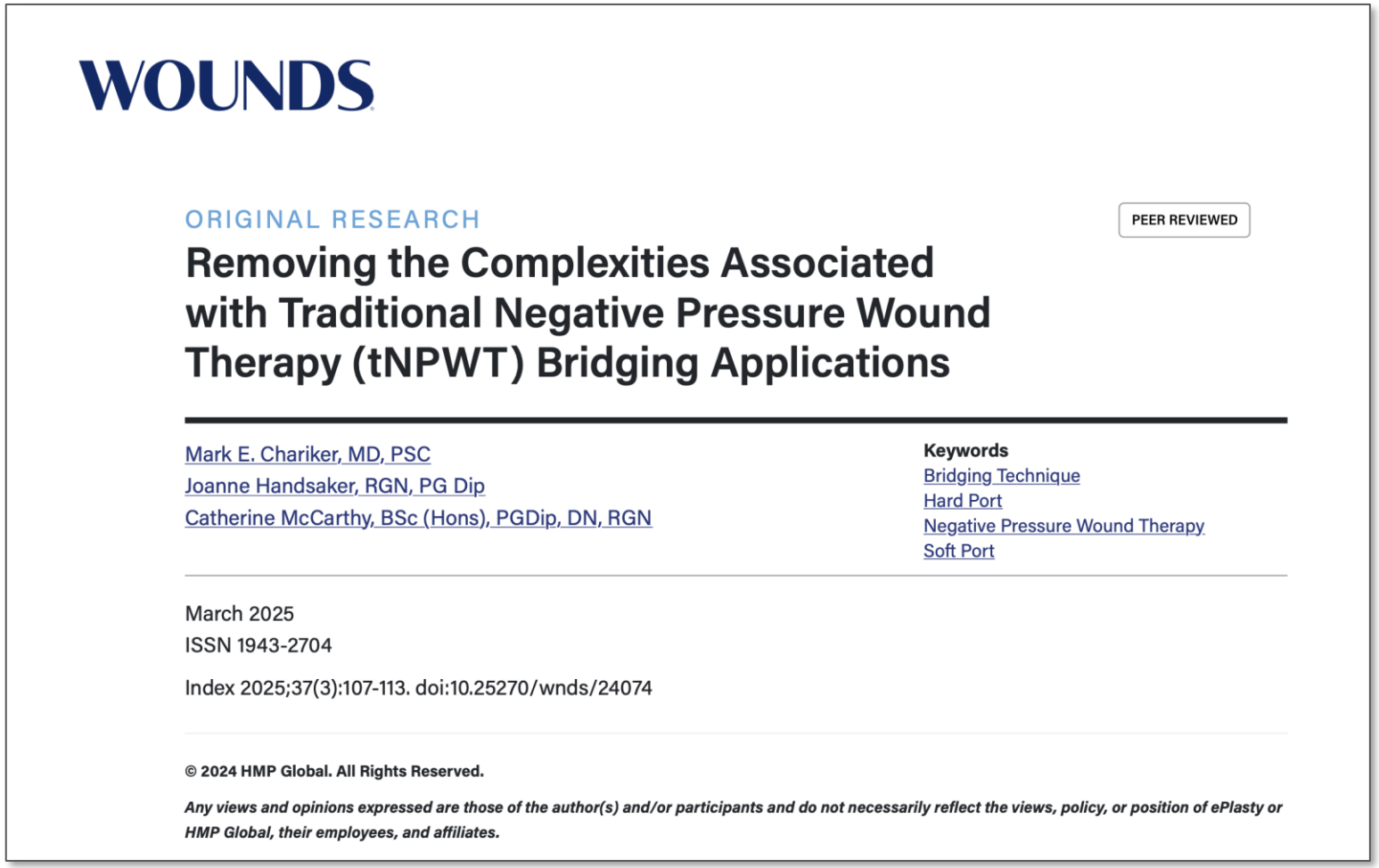
- NPWT instituted POD 3
- RENASYS™ WOUND+ (tNPWT) device chosen due to the wound being entirely posterior and on a weight-bearing surface
- RENASYS™ Soft Port (tNPWT soft port) chosen to reduce the need for bridging and the risk of pressure injury given the expected long treatment course and wheelchair-bound patient
- Reduces risk of increased skin irritation over months of traditional bridge dressings

tNPWT Soft Port



Hudson DA, et al. *Int Wound J*. 2015;12(2):195-201. Carnali M, et al. *Acta Vulnologica*. 2016;14(1):24-39.

tNPWT Soft Port Benefits Complex Wounds



WOUNDS

ORIGINAL RESEARCH

PEER REVIEWED

Removing the Complexities Associated with Traditional Negative Pressure Wound Therapy (tNPWT) Bridging Applications

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Joanne Handsaker, RGN, PG Dip
Catherine McCarthy, BSc (Hons), PGDip, DN, RGN

Keywords
Bridging Technique
Hard Port
Negative Pressure Wound Therapy
Soft Port

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Chariker ME, et al. *WOUNDS.* 2026;37(3):107-113.

Conclusions

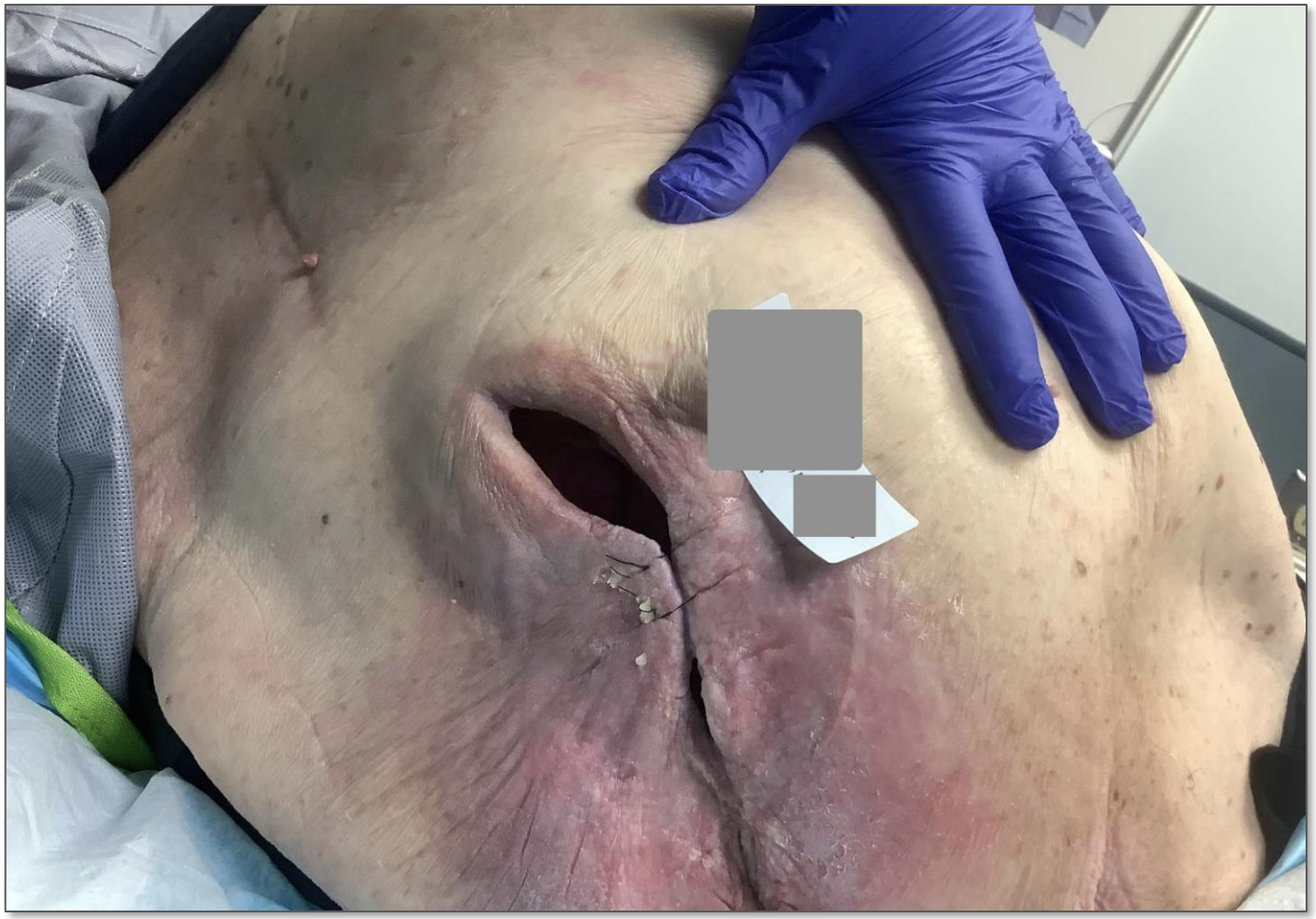
“tNPWT soft ports remain effective regardless of kinks or twists and can eliminate bridging in anatomical areas where patients may weight-bear on tubing or delivery ports, saving time and decreasing risks of periwound trauma.”

Chariker ME, et al. *WOUNDS*. 2026;37(3):107-113.

POD 29



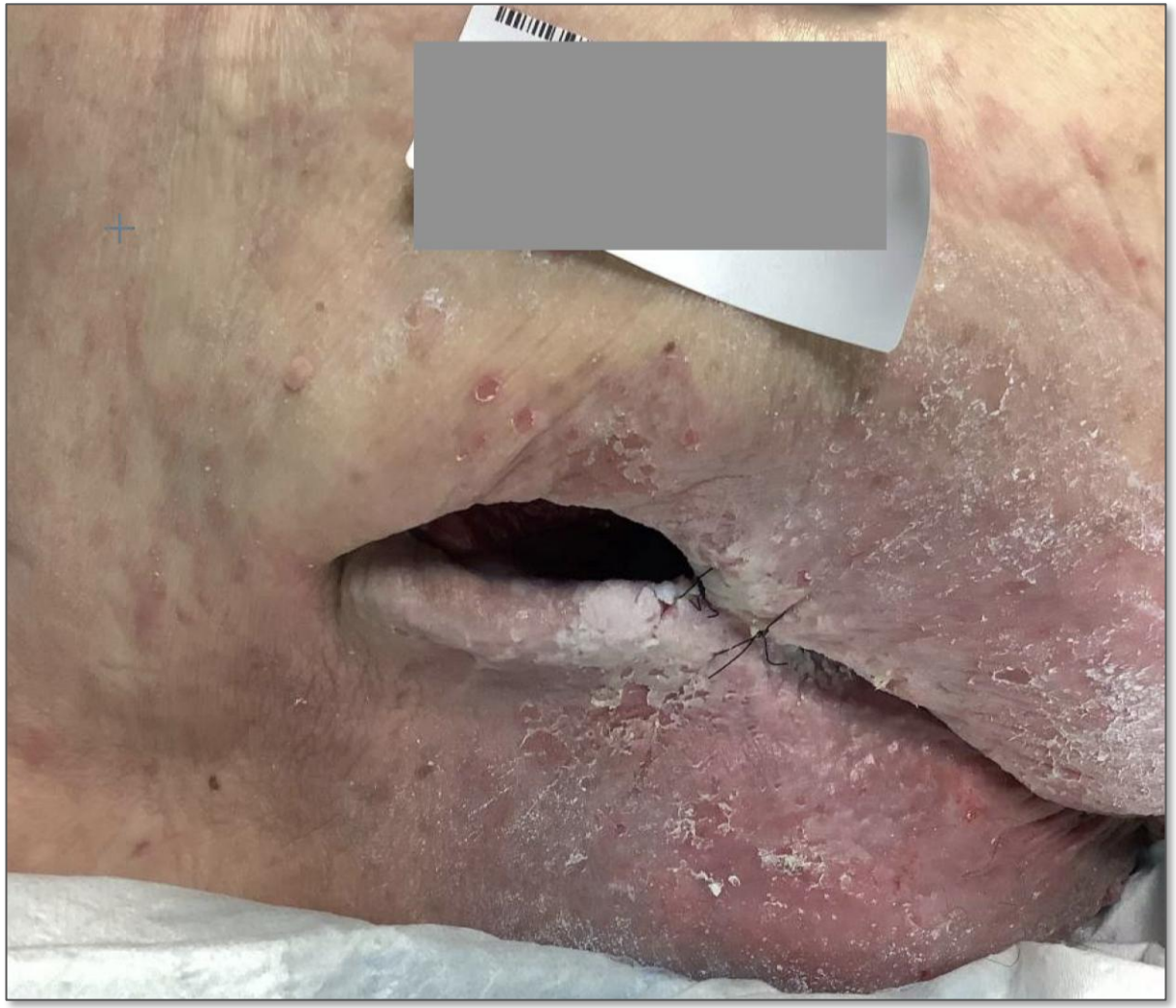
2 months postop



Colostomy Placed

- Despite the wound moving up and away from the anus, NPWT dressings would become dislodged or soiled by uncontrolled bowel movements
- Sigmoid colostomy was successfully created
- Goal of NPWT is to increase granulation and improve undermining

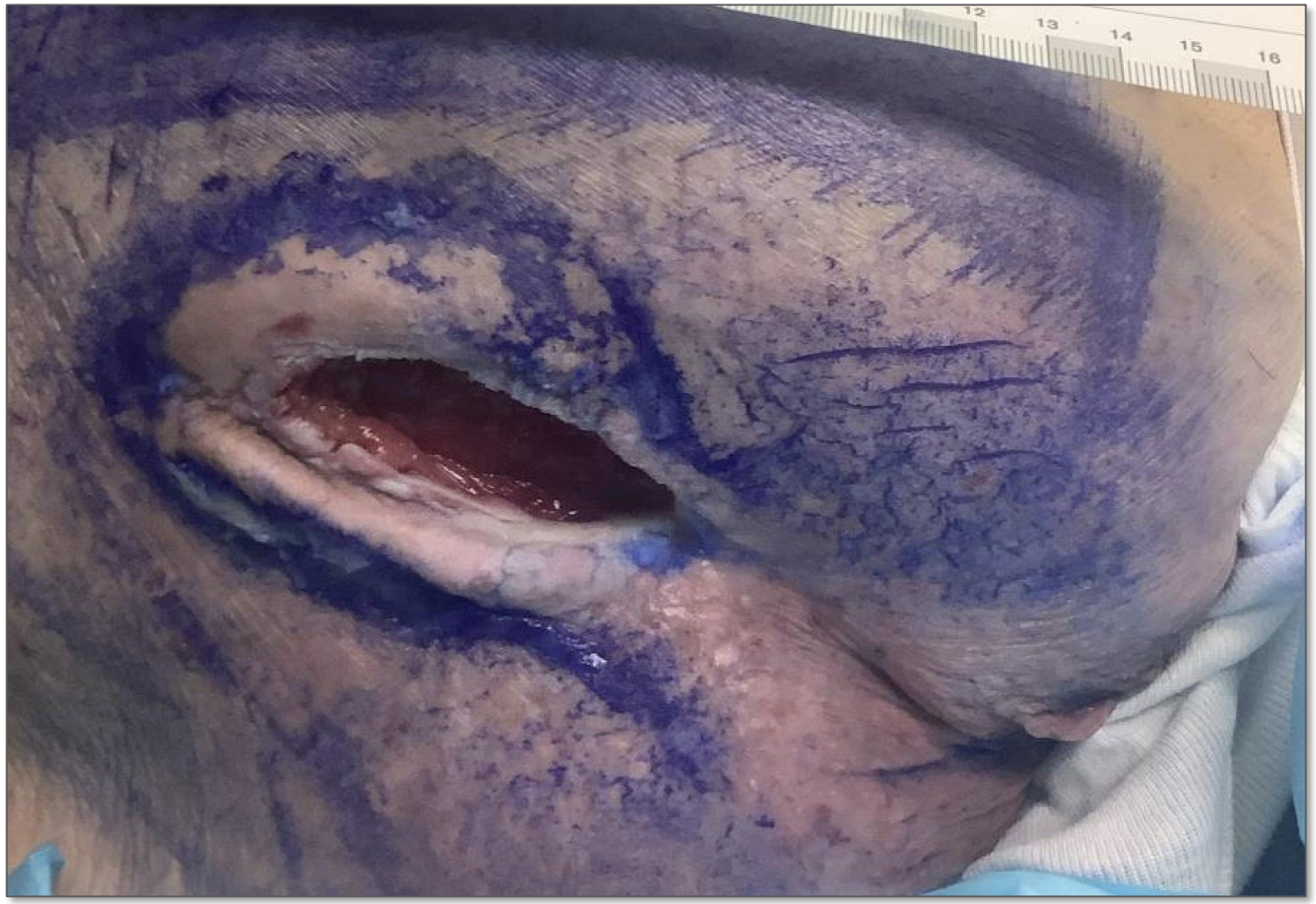
4 months



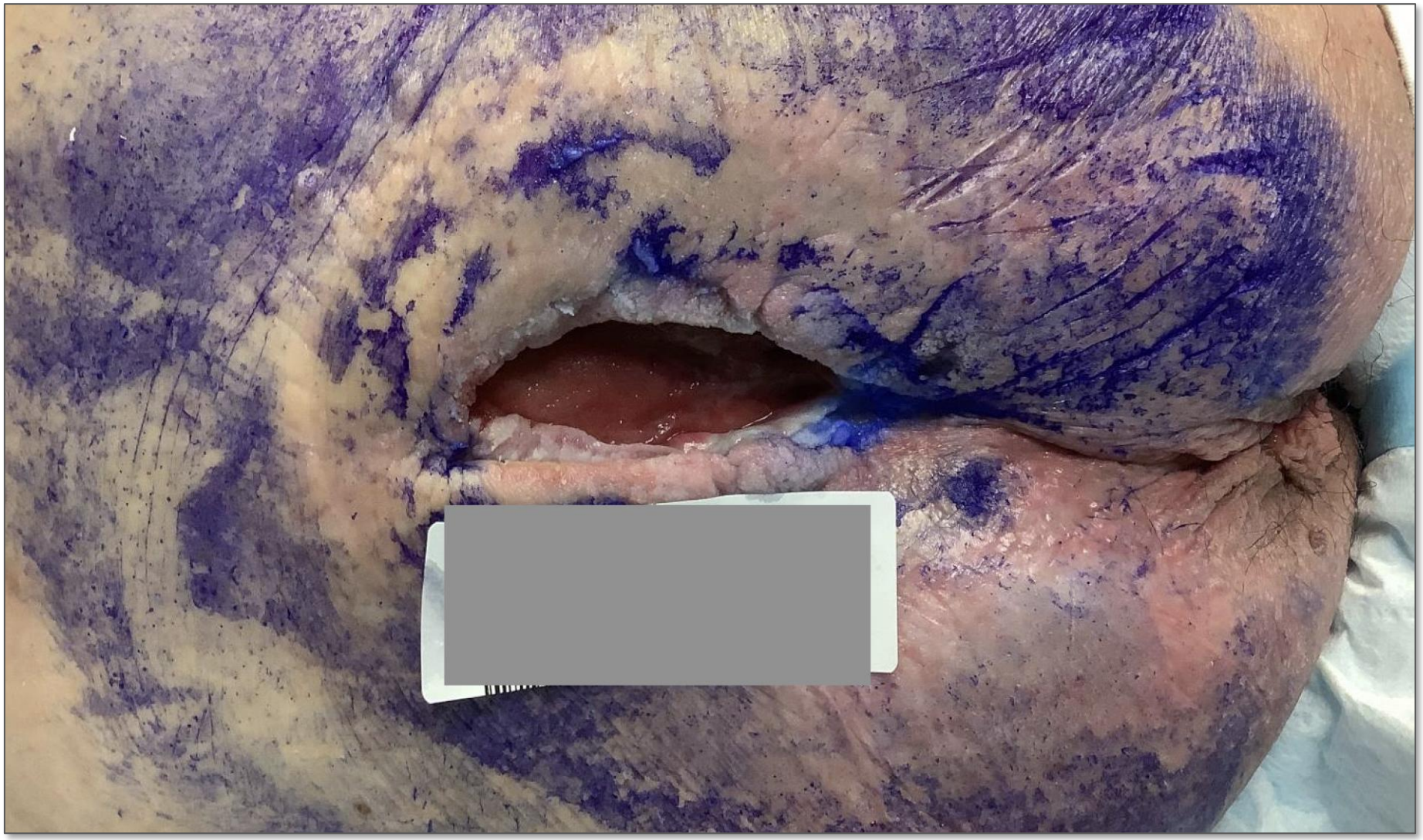
6 months



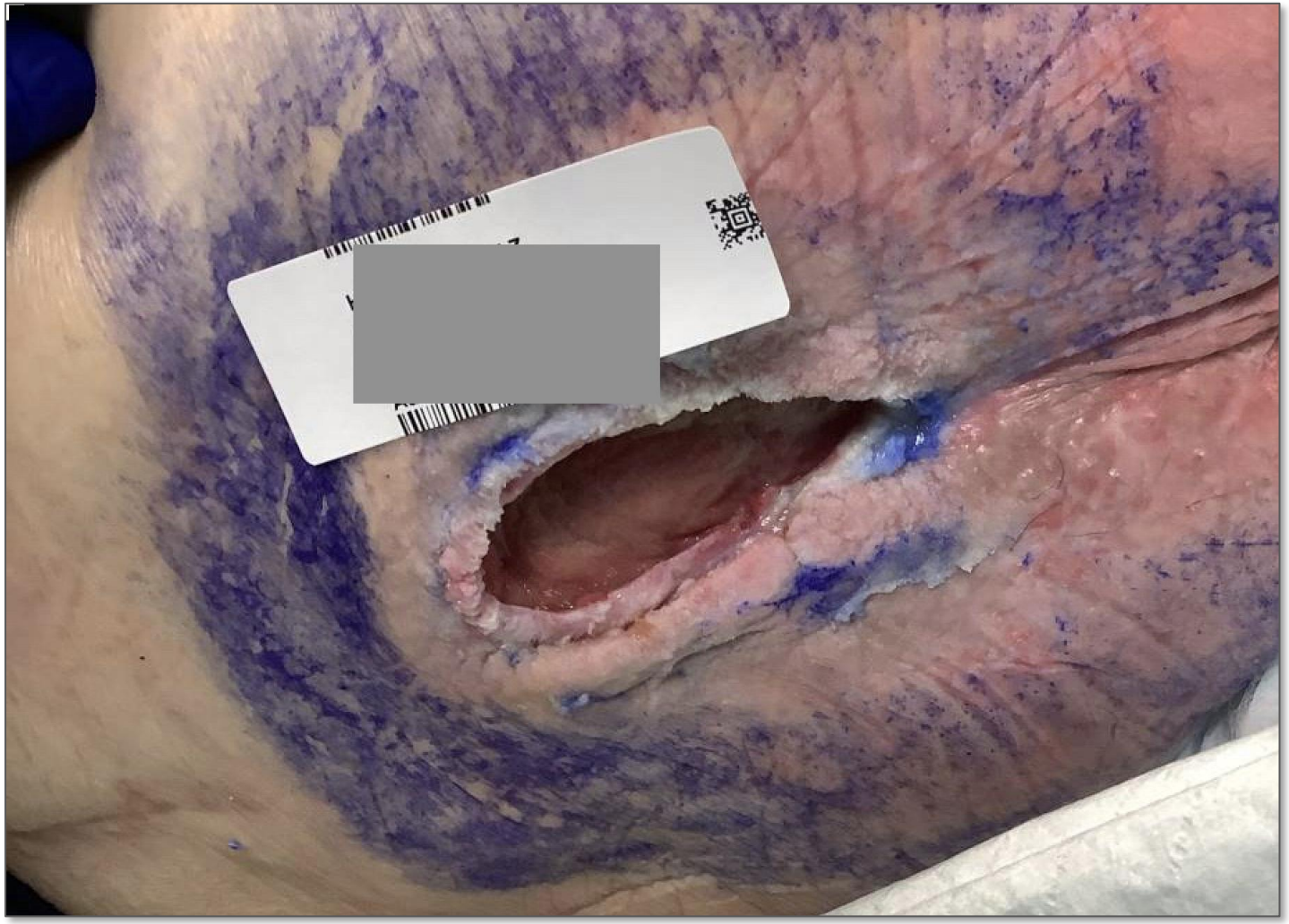
7 months



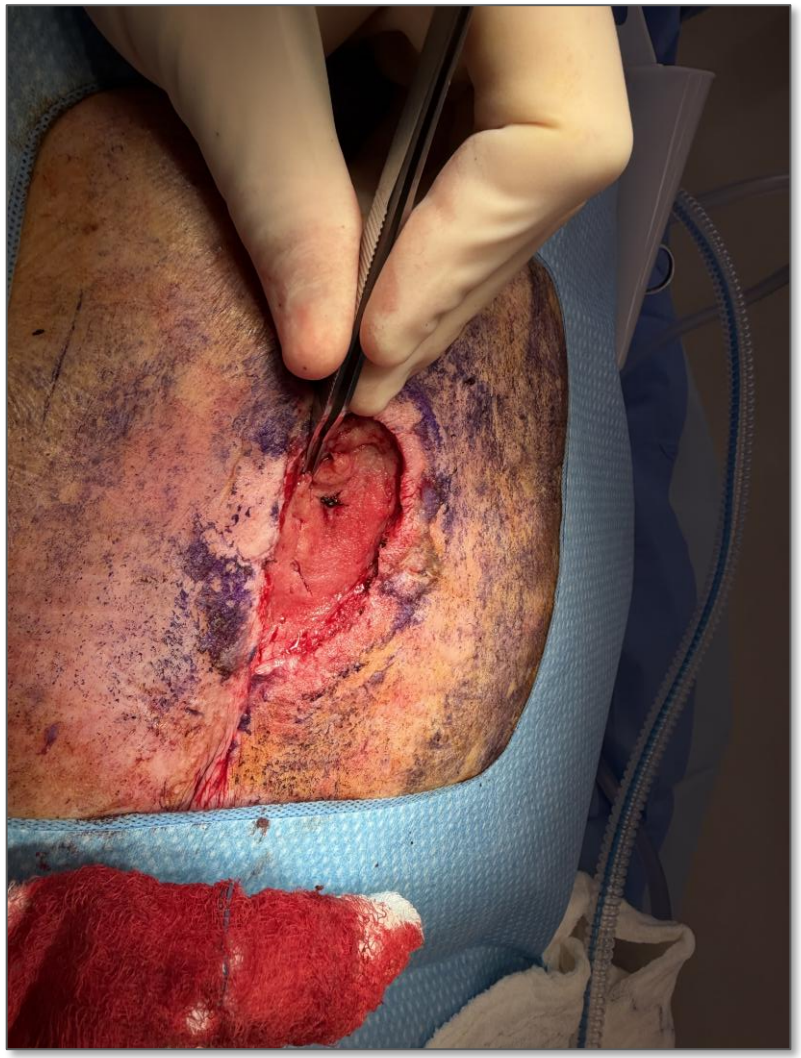
8 months



10 months: Time for Action



Return to OR





- Excisional debridement of wound bed

Reinforced closure with placental membrane graft and NPWT





NPWT Discontinued 4 Months after Closure

- Small area of wound breakdown following closure – continued use of NPWT
- Patient extraordinarily compliant
- Debridement, collagen dressings, and antibacterial foam dressing used over months

6 Months Postop



Non-Healing Spine Incision

Lumbar Spine Disease

- 69y Female with history of lumbar laminectomy (L2-S1) for neurogenic claudication in 3/2021
- Cervical discectomy and fusion 6/2023
- Redo laminectomy with fusion T10-L2 11/2025

Presentation

- Initial presentation 11/2025
- Difficult due to tension on wound edges, slough, and significant residual depth
- Sharp debridement, IODOSORB™ (cadexomer iodine), calcium alginate, and foam dressings



Continued Improvement

- In addition to weekly excisional debridement, SANTYL™ (collagenase ointment) was started and negative pressure applied 12/2025



Traditional Negative Pressure Wound Therapy

- I chose the tNPWT dressing for ease of placement and long wear time
- Patient did not qualify for home nursing services, so weekly dressing placement was ideal
- Given the narrow incision, traditional foam dressings would require window-paning the periwound



tNPWT Applied

- tNPWT started with weekly changes
- Device was discontinued after 2 wks – with the wound functionally healed



Draining Shoulder

Draining Shoulder

- 81y Male with multiple medical problems including CHF, CAD, persistent afib (warfarin), NICM, implanted ICD, creatinine runs ≈4.2 (fistula placed, not yet used), former smoker
- History of prior right open rotator repair many yrs ago
- Presented to outpatient orthopedics with right rotator cuff arthropathy and effusion-aspiration performed culture negative, 69k cells
- Clinically worsened over 2-3 days with recurrent swelling, pain, and decrease in motion, re-aspirated – 40cc purulent fluid
- Presented to ED, WBC 4.7, INR 6.1, BC negative
- Dialysis started in hospital

CHF = congestive heart failure; CAD = coronary artery disease; NICM = nonischemic cardiomyopathy; ICD = implanted cardioverter-defibrillator.

Open Washout

- Frankly purulent, mucinous appearing fluid under pressure
- Destruction of much of the rotator cuff
- Exposed arthritic humerus



Hospital Course

- POD 5: Shoulder aspirated for seropurulent fluid
- OR cultures remained negative: Aerobic, anaerobic, fungal, AFB
- Discharged home on IV Abx
- Pathology negative

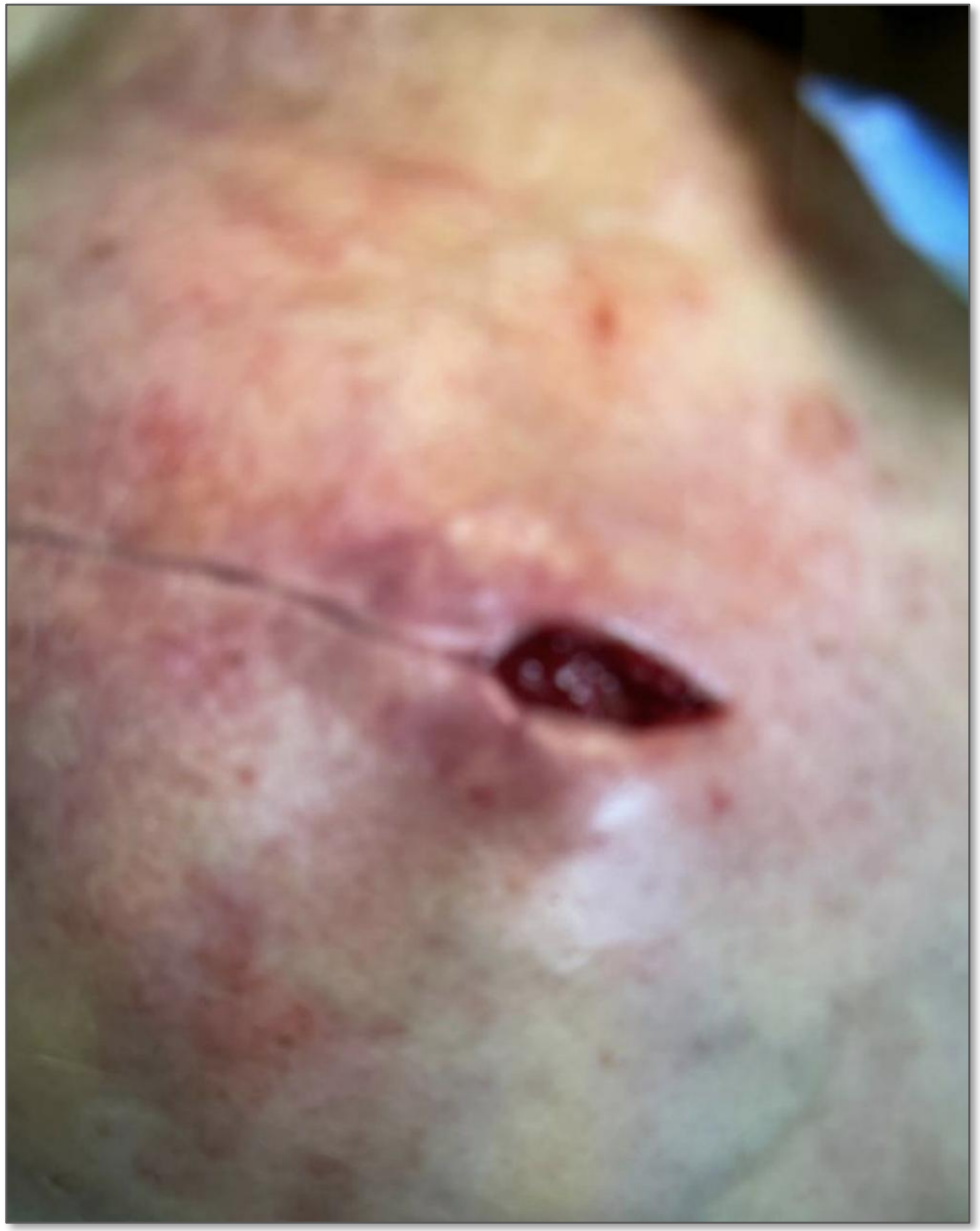
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DIAGNOSIS
A.  Soft tissue, right shoulder, debridement: Granulation type tissue and acute
inflammation.  See comment.
```

AFB = acid-fast bacillus.

POD 13

- Shoulder spontaneously started draining straw colored fluid
- Multiple saturated bandages daily
- Periwound skin irritation

- Presented to me on POD 15



Outpatient Wound Care

- Skin protection
- Management of drainage
- Significant amount of undermining
- Large volume of expressible, mucinous, thickened accumulations
- Culture and cytology negative

Component		
Culture		SEE NOTE
Comment:		
CULTURE, ANAEROBIC BACTERIA W/GRAM STAIN		
Micro Number:	16731108	
Test Status:	Final	
Specimen Source:	Shoulder, right	
Specimen Quality:	Adequate	
Gram Stain:	Moderate White blood cells seen No epithelial cells seen No organisms seen	
Result:	No anaerobes isolated.	
Aerobic Bacterial Culture		SEE NOTE
Comment:		
CULTURE, AEROBIC BACTERIA		
Micro Number:	16731109	
Test Status:	Final	
Specimen Source:	Shoulder, right	
Specimen Quality:	Adequate	
Result:	No Growth	

DIAGNOSIS:
A. Right shoulder, fluid:

SPECIMEN ADEQUACY:
Satisfactory for evaluation.

INTERPRETATION:
Negative for malignant cells, acute inflammation.Negative for microorganisms by PAS and Gram stains.(ThinPrep and cell block examined).

tNPWT Started

- Patient is not home-bound and does not qualify for home nursing
- Patient did not have family who was comfortable with NPWT dressings
- Patient has multiple other medical obligations (hemodialysis) and wants to minimize appointments



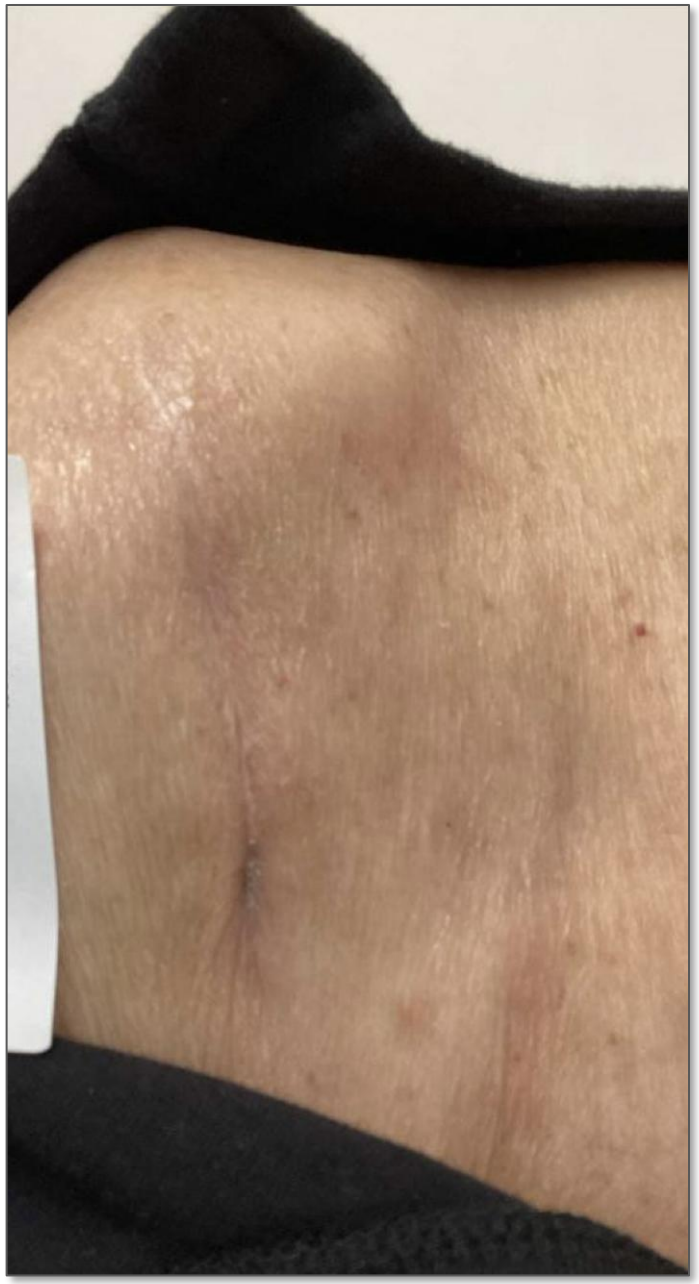
tNPWT Started POD 22



- Weekly changes
- Patient tolerated very well
- Drainage managed without breakdown of periwound skin
- After 1 wk: Significantly less undermining and no further mucinous accumulations
- NPWT discontinued after 4 wks: Closed without drainage!

POD 85: Surveillance Visit

Closure!



Diabetic Gangrene

Initial Presentation

- 53y Female with diabetes, ESRD-HD presents to ED with 1 wk report of foot pain
- HgA1C = 10
- Non-palpable distal pulses



ESRD-HD = end-stage renal disease on hemodialysis.

Operative Care

- 9/28/25: I&D, source control
- 10/3/25: Angiogram with SFA stent x2
- 10/8/25: Popliteal to posterior tibial bypass with reversed vein
- 10/9/25: First ray resection



I&D = incision and drainage; SFA = superficial femoral artery.

POD 7: Cryopreserved Umbilical Tissue Grafting

10/17/25: Grafting of open foot wound with Stravix™ umbilical tissue graft



POD 19



POD 105: Application of Grafix™ Cryopreserved Placental Membrane and tNPWT







Weekly: tNPWT





POD 145: Healed!



Clinical Pearls

- NPWT carries risk, including injury to tissues, bleeding, and DRPIs
- The correct dressing, port, and device should be chosen based on patient needs
- Creative use of NPWT on larger open wounds can improve wound management and help address challenging wound locations